

Spectrum studies in 5GMF

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Spectrum WG in 5GMF

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A graphic of a globe with a grid of latitude and longitude lines, overlaid with the text '5G' in a large, blue, 3D font.

Frequency bands below 6GHz for 5G

The bands below 6GHz will play important roles for 5G as providing:

- Wide and contiguous coverage (e.g. below 2GHz) for:
 - IoT/M2M service with low bit rate and low power consumption,
 - conventional services, and
 - reliable C-plane in a C/U-split heterogeneous network
- Relatively large bandwidth for higher capacity (e.g. above 3GHz) for advanced mobile broadband services.

New candidate bands in Japan are 4GHz band (3.6 – 4.2GHz) and 4.5GHz band (4.4 – 4.9GHz). In these frequency ranges

- Global or regional harmonized frequency arrangement, and
- Sharing and compatibility with the incumbent radio systems should be considered.

Evaluation of spectrum ranges above 6GHz

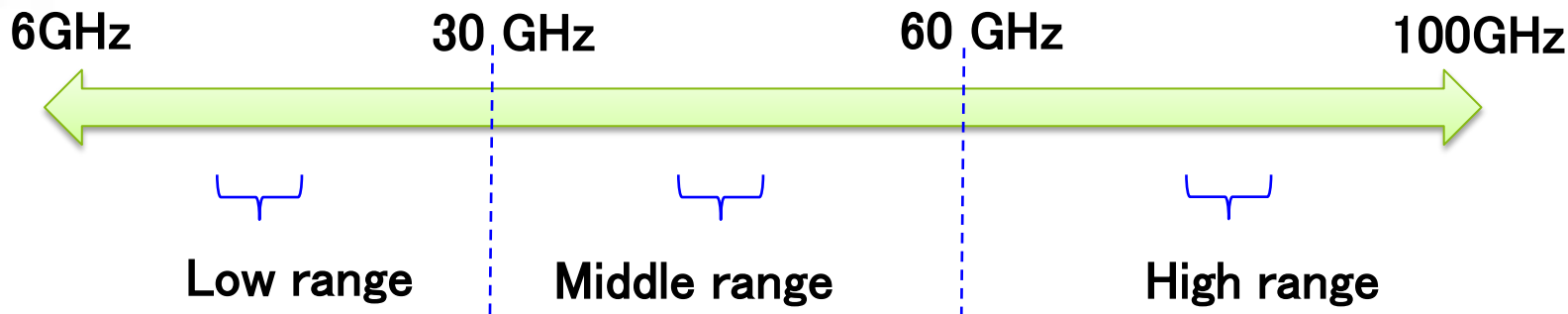
- Evaluate frequency bands from 6GHz to 100GHz from the following viewpoints:

Stage1 : Use cases and technology

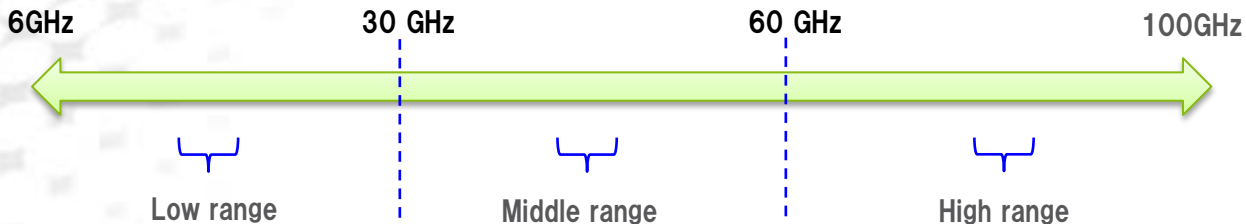
Stage2 : Sharing or interacting with other systems

Stage3 : International cooperation

Classification of Spectrum Ranges above 6GHz in Stage 1



Stage 1: Spectrum ranges above 6GHz and characteristics



- Considering 5G applications (Mobile Broadband, M2M and so on), bandwidth of several 100MHz to several GHz is required per each individual application.
- It is desirable for the bandwidth to be contiguous in order for efficient use of spectrum and implementation.

Spectrum range	Low (6 – 30GHz)	Middle (30 – 60GHz)	High (60 – 100GHz)
Continuous spectrum bandwidth (Note 1)	Approx. 300MHz - 1.5GHz	Approx. 1.5GHz - 3GHz	Approx. 3 – 5GHz
Coverage example (Note 2)	Several 100m – Approx. 1km \longleftrightarrow Several 10m – Approx. 100m		
Deployment scenario	Different scenarios for mobile communication are possible (Outdoor, Indoor, Outdoor to indoor, Hotspot and so on) \longleftrightarrow Scenarios for wider bandwidth and dense deployment (Indoor, Hotspot and so on)		

(Note 1) These values are contiguous spectrum bandwidth assuming that the fractional bandwidth is 5% and referring to the spectrum and bandwidths of the existing 3GPP bands, and not required spectrum bandwidth (spectrum demand).

(Note 2) The coverage values can vary depending on radio propagation condition, deployment scenario, applicable radio technologies and so on.

- **The 11 candidate bands of WRC-19 Agenda Item 1.13 and 27.5-29.5GHz which are mentioned in MIC Report “Radio Policy 2020” as the candidate bands for 5G, are in the scope.**
 - **24.25-27.5 GHz, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz**
 - **31.8-33.4 GHz, 40.5-42.5 GHz and 47-47.2 GHz**

Stage2: Results

Bands above 6GHz with sharing possibility with IMT (6-100GHz)

Frequency bands (GHz)	Bandwidth (GHz)	Evaluation (Note)
24.25 – 24.75	0.5	1
24.75 – 27.5	2.75	3, 4
27.5 – 29.5	2.0	3
31.8 – 33.4	1.6	4
37.0 – 40.5	3.5	4
40.5 – 42.5	2	3, 4
42.5 – 43.5	1	2
45.5 - 47	1.5	4
47 – 47.2	0.2	3
47.2 – 50.2	3	4
50.4 – 52.6	2.2	3, 4
66 – 76	10	3, 4
81 – 86	5	3

(Note) Evaluation criteria is based on sharing possibility with the incumbents systems.

Stage 3: Evaluation

- The bands are evaluated considering the harmonization with the other countries, based on the Stage 2 results.
- The 11 candidate bands of WRC-19 Agenda Item 1.13 and 27.7-29.5GHz which are mentioned in MIC Report “Radio Policy 2020” as the candidate bands for 5G, are in the scope.

Stage3: Investigations for Stage 3

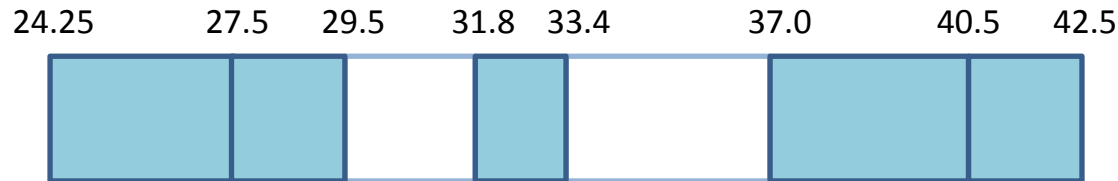
(As of April 2007, refer to the next page for detail)

Frequency band (GHz)	5GMF Stage2	US (FCC)	EU (RSPG)	Korea	China
24.25 – 24.75	1	NPRM (24.25-24.45)	Pioneer band (24.25-27.5)		✓ Global/regional harmonization under WRC-19 AI.1.13 ✓ High priority for bands below 43.5GHz for outdoor deployment
24.75 – 27.5	3, 4	NPRM (24.75-25.25)		(26.5-27.5)	
27.5 – 29.5	3	R&O (27.5-28.35)		(27.5-29.5)	
31.8 – 33.4	4	NPRM (31.8-33.4)	Promising band (31.8-33.4)		
37.0 – 40.5	4	R&O (37-38.6), (38.6-40)			
40.5 – 42.5	3, 4	NPRM (42-42.5)	Viable option (40.5-42.5)		
42.5 – 43.5	2		Viable option (42.5-43.5)		
45.5 - 47	4				
47 – 47.2	3				
47.2 – 50.2	4	NPRM (47.2-50.2)			
50.4 – 52.6	3, 4	NPRM (50.4-52.6)			
66 – 76	3, 4	R&O (64-71) NPRM (71 -76)			
81 – 86	3	NPRM (81 -86)			

- **US (FCC) (FCC 16-89: REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULEMAKING, July 14, 2016)**
 - R&O: Report and Order
 - NPRM: Notice of Proposed Rulemaking
- **EU (RSPG) (RSPG16-032: Opinion on spectrum related aspects for next-generation wireless systems (5G), November 9, 2016)**
 - The RSPG notes the support from mobile industry to the 24.25-27.5 GHz band as a pioneer band for earlier implementation in Europe ...
 - RSPG recognises that the band 31.8-33.4 GHz looks a promising band which could be made available relatively easily by many European administrations ...
 - RSPG considers that the band 40.5-43.5 GHz is a viable option for 5G in the longer term ...
- **Korea (ICT and Future Planning (MSIP), K-ICT spectrum plan, January 18, 2017)**
 - 4 GHz of bandwidth for 5G service in the band above 24.25 GHz: 3 GHz in the band 26.5-29.5 GHz by 2018 when 5G systems are available, at latest by 2021 and additional 1 GHz by 2026 taking into account WRC-19 results.
- **China (AWG-21/INP-30 “5G R&D TRIAL AND CONSIDERATION ON SPECTRUM FOR 5G IN CHINA”)**
 - Promoting global/regional harmonization under WRC-19 AI.1.13
 - High priority for bands below 43.5GHz for outdoor deployment

Stage 3: Results

- Considering the information obtained at this point of time, a part of or whole of the following bands are preferred for initial use, from the view point of global/regional harmonization.
 - 24.25 – 27.5 GHz
 - 27.5 – 29.5 GHz
 - 31.8 – 33.4 GHz
 - 37.0 – 40.5 GHz
 - 40.5 – 42.5 GHz



Thank you for your kind attention.